Recovery of acetic, succinic and lactic acid through Forward Osmosis – a novel down-streaming approach

García-Aguirre, Jon; Alvarado-Morales, Merlin; Angelidaki, Irini; Fotidis, Ioannis

Publication date:
2018

Document Version
Publisher's PDF, also known as Version of record

DTU Environment
Department of Environmental Engineering

Recovery of acetic, succinic and lactic acid through Forward Osmosis – a novel down-streaming approach

Jon Garcia-Aguirre, Merlin Alvarado-Morales, Irini Angelidaki, Ioannis Fotidis*
*ioanf@env.dtu.dk

Introduction

- Microbial fermentation can provide valuable chemical building blocks for industrial application.
- Donwstreaming of the fermentation products is regarded a major bottle neck in conventional fermentation processes.
- Efficient downstreaming approaches are required.

Objectives

- Forward Osmosis (FO) technology was a applied as a novel downstream option for valuable bioproduct up-grading,
- The performance of FO membranes was assessed at pH 3 and pH 7 with synthetic mixtures containing acetic, succinic and lactic acid.

Material and Methods

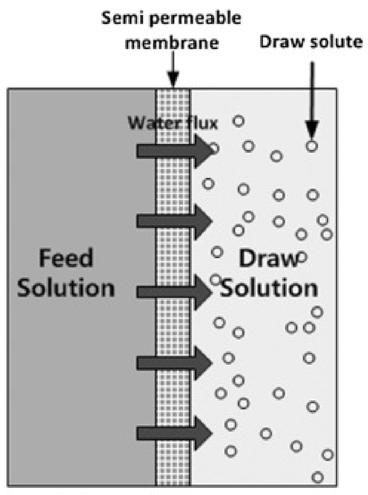

Figure 1. FO theoretical principle.

Membrane Characteristics		
	Flat sheet	Hollow fibre
Membrane area	0.014 m^2	0.3 m^2
Company	FTSH20	Aquaporin

FO Tests		
	Flat sheet	Hollow fibre
Feed solution	20 g/L HAc; HSuc; HLac (2L)	
Draw solution	NaCl 1M (4L)	
Test duration	24 hours	1 hour

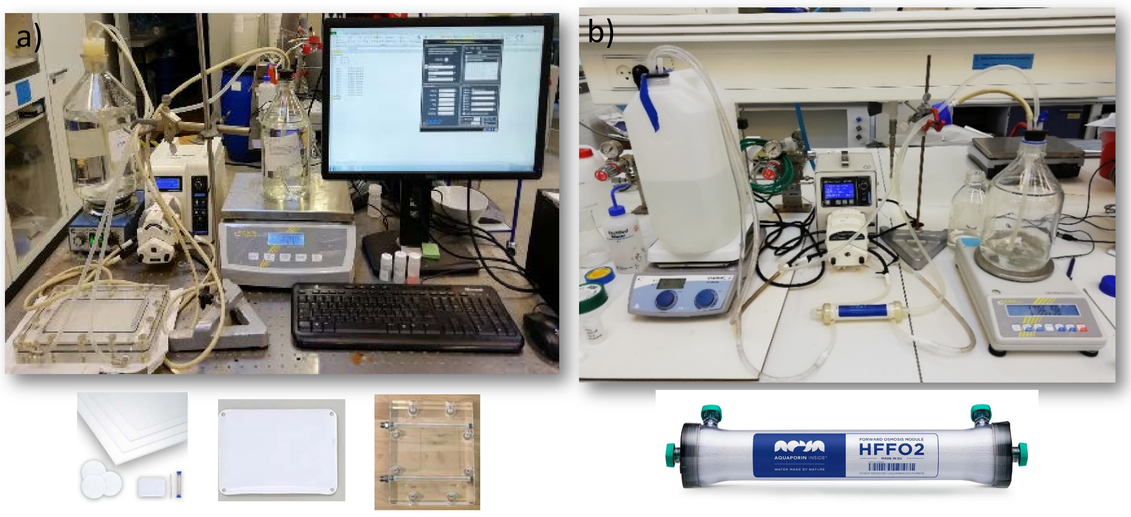

Figure 2. Flat sheet FO set - up (a). Hollow fibre FO set - up (b).

Results and Discussion

FO technology enabled to up-concentrate the target chemicals (Figure 3) and the chemical rejection rate was higher than 90% with hollow fibre configuration (Figure 5).

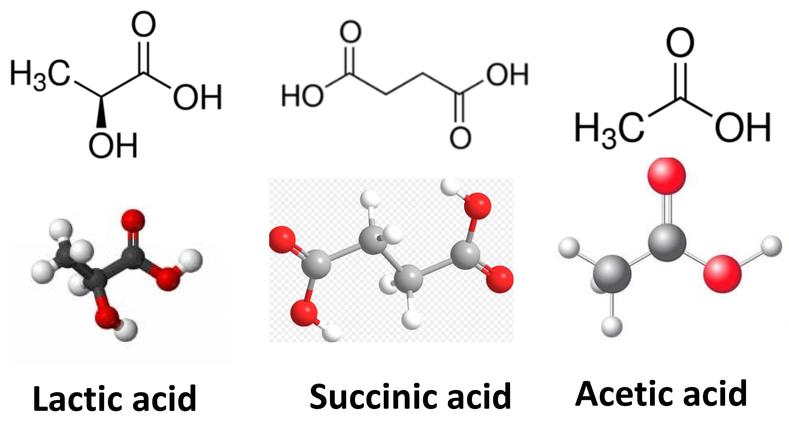

Figure 3. Target chemical up-graded during FO tests.

Figure 4. Succinic acid up-concentration and crystallization at pH 3.

- Promising results are expected from FO technology with real fermentation broths, i.e. lactic acid fermentation (Figure 5d).

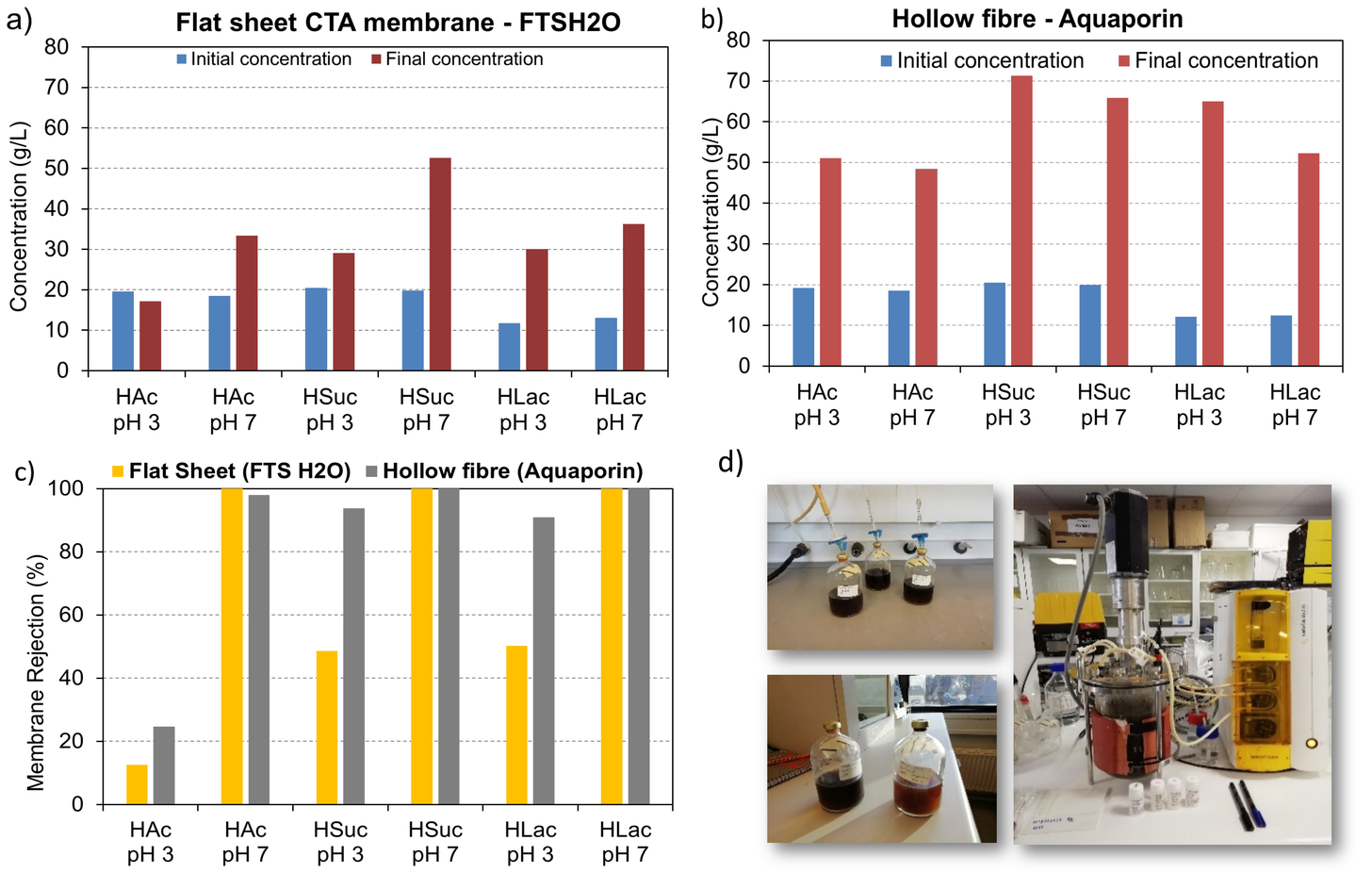

Figure 5. Flat sheet CTA membrane tests results (a), hollow fibre membrane tests results (b), % chemical rejection of the membrane (c), Lactic acid fermentation set-up with Biopulp as substrate and *Lactobacillus Delbrueckii.*

Conclusions

- FO technology was successful for up-grading valuable chemicals that are expected from real fermentation processes.
- Succinic, lactic and acetic acid could be up-concentrated 3.6, 3.3 and 2.6 times respectively, with hollow fibre membranes and acidic pH.

Contact info

Jon Garcia-Aguirre
jgaguirre@ceit.es
Ceit-IK4
Manuel Lardizabal 15, 20018 Donostia/San Sebastian Spain
Denmarks Tekniske Universitet (DTU)
Department of Environmental Engineering – Residual Resources Engineering